

**WE CLAIM:**

1. A birefringent interferometer for use with a polarized input light beam, comprising:

5 a first birefringent element oriented to split the polarized input light beam into a first polarized beam and a second polarized beam having a polarization direction orthogonal to a polarization direction of the first beam;

a second birefringent element oriented to combine the first and second polarized beams into an output beam; and

10 a polarization sensitive detector unit disposed to detect a selected polarization of the output beam.

2. A birefringent interferometer as recited in claim 1, further comprising a light source disposed to transmit the polarized input light beam to the first birefringent element.

15 3. A birefringent interferometer as recited in claim 2, wherein the light source includes a light generator that generates a polarized output as the polarized input light beam.

20 4. A birefringent interferometer as recited in claim 2, wherein the light source includes a light generator that generates an unpolarized output, the unpolarized output passing through a polarizer to produce the polarized input light beam.

5. A birefringent interferometer as recited in claim 2, wherein the light source includes a broadband light generator.

6. A birefringent interferometer as recited in claim 2, wherein the light source includes a laser.

7. A birefringent interferometer as recited in claim 6, wherein the laser is a tunable laser.

5 8. A birefringent interferometer as recited in claim 2, further comprising a controller coupled to control operation of the at least one of the light source and the detector unit.

10 9. A birefringent interferometer as recited in claim 8, wherein the controller includes an analyzer unit coupled to the detector unit to record an output from the detector unit.

10. A birefringent interferometer as recited in claim 8, further comprising an interface unit connected to the controller and couplable to a computer, the controller capable of operating under control instructions received from a computer coupled via the interface unit.

15 11. A birefringent interferometer as recited in claim 1, wherein the polarization sensitive detector unit includes a polarizer disposed to select the selected polarization of the output beam from the second birefringent element.

12. A birefringent interferometer as recited in claim 1, wherein the polarization sensitive detector unit includes a photodetector.

20 13. A birefringent interferometer as recited in claim 12, wherein the polarization sensitive detector unit further includes a spectrometer disposed to disperse the selected polarization of the output beam before reaching the photodetector.

14. A birefringent interferometer as recited in claim 12, wherein the polarization sensitive detection unit includes a light dispersing unit to disperse light received from the second birefringent element and the photodetector is a multiple channel photodetector disposed to detect multiple wavelengths of light  
5 dispersed by the light dispersion unit.

15. A birefringent interferometer as recited in claim 1, wherein the first birefringent element is oriented to receive the polarized input light beam along a z-direction, a y-direction is defined perpendicular to the z-direction and at 45° to the polarization direction of the polarized input light, an x-direction is defined  
10 orthogonal to both the y-direction and the z-direction, and the first birefringent element has an optical axis lying at a selected angle,  $\theta$ , relative to the z-direction in the y-z plane defined by the y-direction and the z-direction.

16. A birefringent interferometer as recited in claim 15, wherein the second birefringent element has an optical axis lying at the negative of the  
15 selected angle,  $-\theta$ , relative to the z-direction in the y-z plane defined by the y-direction and the z-direction.

17. A birefringent interferometer as recited in claim 15, wherein the second birefringent element has an optical axis lying at the selected angle,  $\theta$ , relative to the z-direction in the y-z plane defined by the y-direction and the z-  
20 direction.

18. A birefringent interferometer as recited in claim 1, wherein the first and second polarized beams are spatially separated by the first birefringent element so that the first polarized beam does not overlap the second polarized beam between the first and second birefringent elements.

19. A birefringent interferometer as recited in claim 1, wherein the first and second birefringent elements are separated along a direction parallel to a propagation direction of the ordinary and extraordinary beams so as to leave a gap between the first and second birefringent elements.

5           20. An interferometer, comprising:  
            polarization beam splitting means for splitting an incoming  
            polarized light beam into first and second light beams of orthogonal  
            polarization;  
            polarization beam combining means for combining the first and  
10           second light beams of orthogonal polarization into an output beam;  
            polarization sensitive detection means for detecting polarization of  
            the output beam; and  
            wavelength selection means for selecting a wavelength of light  
            detected by the polarization sensitive detection means.

15           21. An interferometer as recited in claim 20, further comprising  
            polarized light emitting means for emitting a polarized light beam as an input to  
            the polarization splitting means.

            22. A polarization interferometer, comprising:  
            a birefringent beam splitter having an input path and first and  
20           second output paths;  
            a birefringent beam combiner having first and second input paths  
            and an output path, the first and second input paths of the birefringent  
            beam combiner aligned respectively with the first and second output  
            paths of the birefringent beam splitter; and  
25           a polarization sensitive detector disposed on the output path of  
            the birefringent beam combiner.

23. A polarization interferometer as recited in claim 22, further comprising a polarized light source that transmits a polarized light beam along the input path of the birefringent beam splitter.

24. A polarization interferometer as recited in claim 23, wherein the  
5 polarized light source includes a generator of a polarized light beam.

25. A polarization interferometer as recited in claim 23, wherein the polarized light source includes a generator of an unpolarized light beam on the input path to the birefringent beam splitter and a polarizer positioned on the unpolarized light beam between the generator and the birefringent beam  
10 splitter.

26. A polarization interferometer as recited in claim 23, wherein the polarized light source is a tunable light source and further comprising a controller to control an operational wavelength of the tunable light source.

27. A polarization interferometer as recited in claim 22, wherein the  
15 polarization sensitive detector includes a photodetector disposed on the output path from the birefringent beam combiner and a polarizer disposed on the output beam path from the birefringent beam combiner between the birefringent beam combiner and the photodetector.

28. A polarization interferometer as recited in claim 27, wherein the  
20 polarization sensitive detector further includes a light dispersing unit disposed between the birefringent beam combiner and the photodetector.

29. A polarization interferometer as recited in claim 28, wherein the light dispersing unit includes a movable dispersing element, and further

comprising a controller coupled to the light dispersing unit to control a position of the moveable dispersing element.

30. A polarization interferometer as recited in claim 29, further comprising an interface unit connected to the controller and couplable to a computer, the controller capable of operating under control instructions received from a computer coupled via the interface unit.

31. A polarization interferometer as recited in claim 28, wherein the photodetector is a multiple channel photodetector disposed to detect multiple wavelengths of light dispersed by the light dispersing unit.

32. A polarization interferometer as recited in claim 22, further comprising a data analysis unit coupled to the polarization sensitive detector to analyze an output signal from the polarization sensitive detector.

33. A polarization interferometer as recited in claim 32, further comprising a data display unit coupled to the data analysis unit to display data analyzed by the data analysis unit.

34. A polarization interferometer as recited in claim 32, further comprising an interface coupled to the data analysis unit to interface to a computer.

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